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ABSTRACT

A study examined the effects of an instructional intervention designed to improve high school students' ability to comprehend the gist of biology text materials. Subjects were divided into a strategy group, a read-study group, and a control group. The strategy subjects were given eight days of instruction in a procedure designed to help them analyze material sentence by sentence, look for relationships between ideas, and then extract the gist. The read-study subjects merely practiced the task of reading short passages, studying the information, and then recalling it. Subjects were given five test passages throughout the experiment, four biology and one history, and asked to produce an unprobed recall, answer six questions on main idea content, and rate their level of familiarity with the passage content. All subjects were tested before, during, and after the instructional period. The results did not support any one experimental condition over the others, but indicated certain commonalities between the two treatment groups, including the following: (1) those who recalled more total information also recalled more of the important ideas, (2) those who excelled did so throughout the entire experiment, (3) recall ability increased for the subject who excelled in each group. However, the recall of the strategy subjects tended to be more alike than that of the read-study subjects, and the lower-achieving strategy subject showed greater improvement on the question-answering tasks than did the lower-achieving read-study subject. The results reflect the need to consider individual student differences in comprehension in the classroom. (HTH)

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Or Training Students to Extract Gist from Expository Text

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The present study examines the effects of an instructional intervention designed to improve high school students' ability to comprehend gist of biology text materials. Subjects in a high school biology course were divided into three groups, two treatment conditions and one non-treatment control group. The three experimental conditions included: 1) Strategy group; 2, Read-Study group; and 3) Control group. The Strategy subjects were given eight days of instruction in the application of an explicit strategy for identifying gist or main ideas. This experimenter-created strategy is a two-step procedure designed to help students analyze material sentence-by-sentence, looking for relationships between ideas. In Step Two, the strategy also aids students in synthesizing this micro-analysis to extract the major ideas or gist of the text. The Read-Study subjects merely practiced the task of reading short passages, studying the information, and then recalling it (the criterion test task). The Control subjects received no experimenter intervention. They continued with regular classroom instruction by the biology teacher.

Like other instructional studies (Gordon, 1979; Hansen, 1979), overall effects favoring the effectiveness of Strategy instruction were limited and predominantly contextually-specific. It was therefore felt that a more detailed examination of several subjects' performance throughout the course of this experiment might yield descriptively rich findings, perhaps capturing a notion of how teaching procedures impede or facilitate comprehension of expository text.

In essence, several students from each experimental condition were flagged in order to: 1) explore any differences or similarities between subjects in the same condition; and 2) probe for possible relationships across groups.

In the attempt to explore the extent to which any of the three experimental conditions affected the subjects' comprehension, two students in each group were selected. Since reading ability was felt to be an integral part of the study, the students chosen were those who had scored comparably on a standardized reading test given prior to the onset of the experiment.

To measure the extent to which comprehension was affected by each of the three experimental conditions, subjects were given a total of five test passages throughout the course of the experiment. Sources for these comprehension measures were five 250-300 word passages taken from actual high school textbooks. Four of the five passages were biology content; one was a history passage. On each of the five tests, subjects were asked to read the passage, study it, produce an unprobed recall then answer six questions on main idea content. Subjects were also instructed to rate their level of familiarity (using a scale of increasing familiarity, with 1=unfamiliar up to 5=most familiar) with passage content. All subjects were given a pre-test, a mid-test (after four days or half the instructional period), two post-tests (one with biology content, one with history content), and a delayed post-test.

Subjects' recalls of passages were compared to template text bases using a propositional analysis system based on work by Kintsch (1974), and codified by Turner and Green (1977). Variables examined in the attempt to assess subjects' comprehension of the material included: types of propositions recalled, amount of total propositions recalled, amount of important propositions recalled, and score on the question-answering task. Based upon the notion (Kintsch & van Dijk, 1978) that inferences could be drawn about processing differences from the amount

and the generality level of information recalled, recall protocols were classified by type. Proposition types included: Text Reproductions (exact or synonymous representations of text base propositions), Entailments (summaries or generalizations of text base propositions), and Evocations (recall protocols which are not directly linked to text base). Throughout the experiment, these subjects produced very few evocations. Therefore, in this discussion, the focus will be centered upon text reproductions and entailments. "Important prositions" are those propositions selected by independent raters as being topmost in importance.

To further the investigation of possible differences and similarities between subjects and conditions, order of recall (i.e., consecutive as appearing in the original text or mixed) and familiarity rating were examined.

Effects within groups can be seen by exploring subjects in each experimental group separately, looking both at performance on passages individually and at performance across the five passages.

The Strategy group was taught a two-step procedure for analyzing relationships between ideas in text. Step One consisted of a micro-level analysis of sentence components in which subjects separated each sentence into TOPIC (what the sentence was about) and COMMENT (what was being related about the topic). Relationships between ideas in sentences (i.e., example, definition, property, cause/effect, similarities/differences) were emphasized. Subjects were given instruction and practice in the identification of relationship types. Step Two was a macro-level analysis in which subjects grouped information from the Topic/Comment analysis, condensing and combining important ideas and deleting unimportant details. The outcome of Step Two was for subjects to create important subtopics suggested by the text content. The intended purpose of Steps One and Two was to aid readers

in determining relationships between ideas, helping them to recognize main ideas in text, thus enabling them to better comprehend the gist of the text.

Entry level competencies were determined by the pre-test. For the Strategy subjects, large differences favoring the performance of Subject 1 arose both in total amount of recall and in the amount of important ideas recalled. Subjects' recalls both favored text reproductions over entailments and mixed order rather than consecutive order. Both subjects scored 61% accuracy on the question-answer task, despite the fact that both subjects were familiar with the content. (Subject 2's familiarity level was 3 and Subject 4's familiarity level was 4). Thus, before the instructional intervention, although the subjects seemed to differ in their ability to recall main ideas in an unprompted recall, they were able to answer questions on main idea content with comparable ability.

The mid-test was given after subjects received instruction in Step One of the strategy (the micro-analysis, construction of a Topic/Comment List). After reading the passage, subjects were asked to create a Topic/Comment List of all the sentences and to turn this in before giving the written recall of the passage. This activity had been taught to the subjects and practiced (with other biology materials) in the first four days of the experiment. Inspection of the Topic/Comment Lists of Subjects 1 and 2 revealed great similarities in wording of components. However, only Subject 1 included the identification of relationship types. From this, one would suspect that the classification of relationship types might have enabled Subject 1 to outperform Subject 2, at least on the question-answering task. This was not the case. Both subjects' scores improved significantly over the pre-test, but Subject 2's score (94%) exceeded that of Subject 1 (89%). Regarding total recall and recall of important ideas, the reverse of what occurred on the pre-test

was found. Order of recall was mixed for both subjects. The familiarity levels dropped for both subjects (Subject 1 rated familiarity 1; Subject 2 rated it 2). One might suspect that with a decrease in familiarity, comprehension would also plummet. This, however, was not the case. Results on the mid-test suggest the possibility that the Step One strategy instruction may have influenced the higher question scores and, in the case of Subject 2, it seemed to have encouraged much better recall of important ideas.

The biology post-test was given immediately following completion of the second half of strategy instruction (the construction of subtopics, Step Two). In completing this post-test, Strategy subjects were asked to create and hand in a Topic/Comment List and a list of subtopics for the test passage. Despite the fact that again Subject 2 made a more detailed Topic/Comment list (which included relationship types on all components), subjects came up with very similar important subtopics. In spite of this similarity, the trend continued for Subject 2 to recall much more, and to recall more important ideas. (In fact, Subject 1 recalled none of the important ideas). Recall type favored text reproductions for Subject 2 and entailments for Subject 1. Recall order was mixed for both subjects. What is most unexpected from these results is that, despite the lower performance in total recall and recall of important ideas, Subject 1 outperformed Subject 2 on question score, with a 94% as compared to a 78%. Both subjects rated familiarity identically (2). Some evidence (i.e., the case of Subject 1), therefore, suggests that the strategy instruction may be influencing the recall of important content only when prompted by questions. The greater frequency of entailments produced by this subject may also signal a possibly greater benefit of non-verbatim recall over the verbatim (text reproduction) recall in responding to question prompts. For Subject 2,

however, the identification of Topic/Comment relationship types promoted by the strategy perhaps encouraged the greater recall of important ideas on the unprompted recall task. What this suggests is that the benefits of strategy instruction is highly individualized among subjects of comparable reading ability.

On the history post-test, strategy subjects were merely instructed to mentally perform the strategy before attempting the comprehension tasks. This measure directly followed the biology post-test. A different content (history) was used to see if other effects would be manifested when subject matter was changed. Again Subject 2 recalled much more than Subject 1. Likewise, Subject 2 recalled more (100%) of the important ideas. Both subjects produced more text reproductions than entailments. Subjects differed in the order of recall, Subject 1 producing consecutively ordered information and Subject 2 with mixed order recall. Subject 2 had a perfect score (100%) on the question-answering task; Subject 1 scored 94%. What these results suggest, contrary to the biology post-test results, is that verbatim recall appears to increase prompted recall. In addition, unlike previous results, recall of most important information did seem to positively affect question score. These results indicate the need for further investigation of the text differences between dissimilar content material (e.g., biology and history).

To see if any effects of strategy instruction on long-term memory would occur, subjects were given a biology passage to read, and week later they were asked to recall the content. Strategy subjects were again ask d only to perform the strategy in their minds. Only Subject 2 was able to produce <u>any</u> written recall. Text reproductions and entailments were produced almost equally. Recall was not in consecutive order. The majority (75%) of important ideas were included in the recall. Suject 2's question score (83%) far exceeded that of Subject 1 (44%). Again, familiarity ratings were identical (2).

Conclusions are not easily drawn. Evidence from Subject 2 suggests, however, that strategy instruction, even as a thought process rather than a written procedure, may be enough to encourage recall of important information, resulting in greater comprehension of main ideas. Given that individuals often differ in the amount of instructional time and practice needed to learn effectively, it is probable that Subject 1 required a longer instructional period than Subject 2 to fully benefit from the strategy instruction.

Looking across test passage performance of the Read-Study subjects, it is important to remember that these subjects had received practice in reading biology passages, studying them (by whatever method chosen), and writing recalls of the content. Thus, these subjects received practice in the unprompted recall criterion task. No formal instruction was given, however.

On the pre-test, Subject 3 recalled slightly more information than did Subject 4. Subject 3 produced a greater number of entailments than Subject 4. Both subjects, however, failed to remember any of the most important information on the unprompted recall. Despite this, Subject 3 outperformed Subject 4 on the question-answering task, obtaining 83% accuracy. Subject 3 recalled information in consecutive order; Subject 4 did not. Since Subject 3's familiarity rating was slightly higher (2 as compared to 1), the increased familiarity may have resulted in more information retained. So the initial competencies of these subjects differed in terms of total recall, type of recall, and question score; however, both subjects failed to recall the important information from the passage.

After four days of practice, the mid-test was given. Again Subject 3 recalled more total information, more than double that recalled by Subject 4. Both subjects produced a greater number of text reproductions than entailments. Subject 3

recalled information in consecutive order; Subject 4 did not. Both subjects improved in their ability to recall important ideas as compared to performance on the pre-test; still, Subject 3 outperformed Subject 4, recalling 88% of the important ideas as compared to 75%. The question score of Subject 3 (89%) perhaps reflects this. On the other hand, the ability to recall important information seemed to have adversely affected the question score of Subject 4 (who scored 39%). Familiarity ratings were identical (2). While these results are indeed baffling, one plausible explanation can be forwarded. Practice may have at this time positively influenced Subject 3's comprehension performance, but for Subject 4, effects may be seen only on the recall of important ideas.

The post-tests were given following the completion of the entire practice period (eight days). On the biology post-test, Subject 3 again recalled more information and more important ideas than did Subject 4. In addition, the subjects differed in their preferred types of recall. Subject 3 produced more text reproductions than entailments; Subject 4 produced equal numbers of text reproductions and entailments. Subject 3 again recalled a greater percentage of important information (75%) as compared to that of Subject 4 (50%). Order of recall for both subjects was mixed. Subject 3 once again scored much higher on the question-answer task (94%). Familiarity ratings for the two subjects were identical (1). For Subject 3 only, it appears that the effect of practice positively influenced question score and recall of important information.

On the history post-test, Subject 3 again outperformed Subject 4 on total amount recalled, question score, and on recall of important ideas. Both subjects produced more text reproductions than entailments. Subject 3 recalled information consecutively and Subject 4 in mixed order. Subject 3 recalled all of the

important ideas; Subject 4 recalled 73%. One probable explanation may lie with the fact that Subject 3's familiarity rating for this passage was 3, higher than any previous rating. Perhaps the combination of practice effects and the different (and more familiar) content material affected the comprehension performance. Subject 4 also improved considerably over previous testing performance both in recall of important ideas and in question score with this different content. What these results suggest is that with the different content, different variables are operating, interacting with the experimental conditions, affecting results. Again, evidence suggests the need to explore further variables found across different text content.

On the delayed post-test, only Subject 3 produced written recall. On that, Subject 3 produced more text reproductions than entailments. In addition, half the most important propositions were recalled. The order of recall was mixed. Question score for Subject 3 was 78%, lower than previous tests but higher than that of Subject 4 (61%). Subjects rated familiarity identically (2). As found with the Strategy subjects, the beneficial effects of practice appear to be highly individual. Evidence suggests that for Subject 3, practice may have improved the ability to recall important ideas. This effect, however, was not as apparent with Subject 4.

Last, performance of the control subjects is examined. On the pre-test, Subject 6 recalled more information than Subject 5; this recall was comprised of more text reproductions than entailments. For Subject 5, however, the reverse is true. Subject 6 recalled 25% of the important information; Subject 5 recalled none of the important information. Order of recall for both subjects was mixed. Subject 6 outperformed Subject 5 on question score with a 61% accuracy as compared to 56%. There was a big difference in the familiarity ratings. Subject 5 claimed

no familiarity (1) while Subject 6 claimed quite high familiarity (4). Initial competencies of these two subjects, therefore, are quite different.

On the mid-test (after half the instructional period, where the control group merely continued with regular classroom instruction), Subject 6 produced more than double the amount of recall than Subject 5. Both subjects produced more text reproductions than entailments. Order of recall was consecutive for Subject 5, but not for Subject 6. More important ideas were recalled by Subject 6 (75%). The results on the question-answering task, however, were identical (78%). Again, familiarity ratings differed. Subject 5 rated familiarity 1; Subject 6 rated familiarity 3. From the time of the pre-test until the mid-test, both subjects improved in their ability to recall important ideas and in their ability to answer questions accurately. It is surprising, perhaps, to note that Subject 6 was more familiar with the content (rating = 3), but still scored identically on the question-answering task.

On the biology post-test, Subject 5 recalled slightly more than Subject 6. Text reproductions were produced most often by both subjects. Subject 6 recalled half of the most important information, while Subject 5 recalled only a quarter. Both subjects recalled information in mixed order. On this passage, Subject 6, whose recall of important information was higher, and whose familiarity rating was much higher (3), acquired the higher question score (89%). This may indicate the expected facilitative effect on prompted recall for subjects who recall more important ideas and whose familiarity is high. Thus, it appears that after the entire eight day period, these subjects who had regular classroom instruction seemed to have improved in both their ability to answer questions about passage content and in their ability to recall important ideas.

On the history post-test both subjects again produced more text reproductions than entailments, with Subject 5 recalling more total information. Recall in both cases was consecutive. Both subjects recalled 73% of the most important information, but the results of the question score differed. Subject 5 scored 72%; Subject 6 scored 83%. Subject 6's familiarity rating was 3 as compared to the rating (1) of Subject 5. This again suggests that familiarity with content may promote greater accuracy on a question-answering (prompted recall) task.

On the delayed post-test, both subjects did produce written recalls. Subject 5 recalled more information. Both subjects produced only text reproductions. Recall order was consecutive for Subject 5, but mixed for Subject 6. More important ideas were recalled by Subject 6 (75%) than by Subject 5 (25%). Surprisingly, this resulted in a much lower question score for Subject 6 (56%). Subject 5 scored higher (78%) on the question-answering task. Again, results are non-conclusive. What appears, however, is that for the control subjects, little improvement is found for any of the comprehension measures from the time of the mid-test on.

The descriptive data, unfortunately, does not clearly indicate support for any one experimental condition over the others. However, certain observations can be made which indeed point to the need for further investigation. Results from both treatment conditions, the Strategy group and the Read-Study group, share certain commonalities which are: 1) The individuals who recalled more total information also recalled more of the important ideas; 2) There was a fairly consistent pattern; the subject who excelled did so throughout the four passages (all following the pre-test); 3) Ability to recall important ideas steadily rose for the excelling subject in each group; 4) Question score accuracy accompanied the excelling subject in each group; and 5) There was a predominance

of text reproductions produced by all subjects. Some differences are: 1) The recall of the Strategy subjects tended to be more alike in that it was most often mixed order rather than consecutive order; and 2) The lower-achieving subject in the Strategy group showed greater improvement on the question-answering task throughout the experiment than did the comparable subject in the Read-Study group.

The Control group subjects, on the other hand, exhibited a different pattern. First, the excelling subject differed on each passage. Sometimes, this could be attributed to higher familiarity ratings. In addition, the subject with the greater total recall often did not remember more of the important ideas. Like the Strategy and Read-Study subjects, however, those subjects who recalled more of the important ideas most often scored higher on the question-answering task. Improvement on both the question-answering task and on the ability to recall important ideas was not as great for the control subjects. Scores on both these measures never equalled the top scores for subjects in the other two treatment groups.

Results of this detailed examination of comprehension performance reflect the complexity of research within classroom communities. First of all, the need to consider individual differences between students is apparent. Second, the effects of multiple variables regarding text content and instructional procedure warrants further investigation. These results suggest that practice as an instructional technique may indeed promote performance. Yet, results also indicate that a carefully planned instructional procedure may promote greater gain in improvement than mere practice. The rather steady performance of the Control subjects may indicate the benefits of constant, teacher-directed activity. However, for improvement to occur, perhaps more student-directed procedures are advisable.

Results also point to the need for broader exposure during instruction. That is, when attempting to teach a particular learning strategy, it is important to try to incorporate a variety of subject matter materials.

What emerges as most important from this study is the fact that certain preconceived ideas about comprehension fail to be conclusively supported. For instance, one would strongly expect that higher familiarity with text content would facilitate comprehension of main ideas. This was not confirmed by these results. In addition, the supposed deeper processing involved in producing entailments is often expected to facilitate comprehension. In this study, text reproductions seemed to promote comprehension better, especially on the prompted recall (the question-answering task). Furthermore, results suggest that perhaps there is a different instructional need for prompted versus unprompted recall tasks. Thus, depending on the particular comprehension measure, educators may have to take closer care to design instructional activities to suit criterion tasks. Finally, one would suspect that in comparing readers of comparable ability under three different instructional settings, sharp differences might emerge. Results from this study seem to be more subtle. There is no clear evidence or strong support for any one instructional procedure over the other. Indeed, the intricacies of an interactive learning situation (i.e., reading and comprehension of text materials) point to a need for additional exloratative research of this kind.

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